Ordering number : EN5658A
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Monolithic Linear IC

LA1827M

Single-Chip Tuner IC for Portable Radio /Cassette Recorders

Overview

The LA1827M is a single-chip tuner IC for FM and AM with built-in MPX-VCO which requires no adjustment and no external parts.

Functions

- AM: RF amplifier, mixer, oscillator, IF amplifier, detector, AGC, tuning display output
- FM-FE: RF amplifier, mixer, oscillator
- FM-IF: IF amplifier, quadrature detector, signal strength meter, tuning display output
- MPX: PLL stereo decoder, stereo display output, forced mono, internal VCO

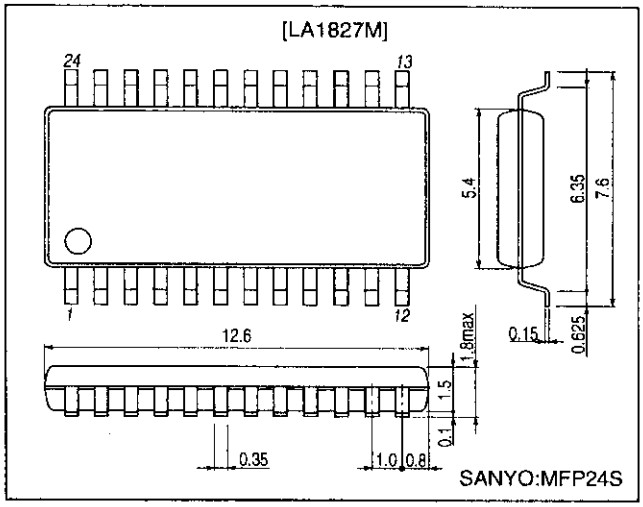
Features

- Single-chip tuner with AM, FM-FE/FM-IF, MPX circuitry
- Built-in adjustment-free MPX-VCO (no ceramic oscillator required)
- FM-DET, adjustment-free (using ceramic discriminator)
- Reduced FM-FE oscillation level
- FM stereo indication and AM/FM tuning indication pins provided.

Package Dimensions

unit:mm

3112-MFP24S



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC}max		7.0	V
Indicator drive current	I_{LED}		20	mA
Allowable power dissipation	Pd max	Ta ≤ 70°C	250	mW
Operating temperature	Topr		−20 to +70	°C
Storage temperature	Tstg		−40 to +125	°C

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TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

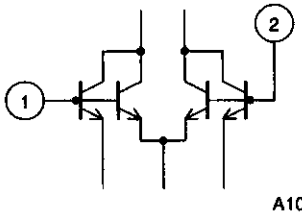
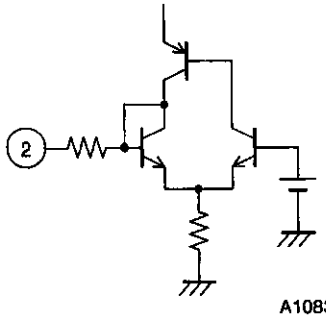
Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3.0	V
Operating supply voltage range	$V_{CC}op$		1.8 to 6.0	V

Operating Characteristics at Ta = 25°C, Vcc = 3.0V, in specified test circuit, using Yamaichi Electronics socket IC51-0242-543

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM-FE characteristics]: fc = 98 MHz, fm = 1 kHz, 30% mod.						
Local oscillator voltage	V_{OSC}	No input, f_{OSC}=108.7 MHz, pin 20 output *Measured with FET buffer (-10 dB gain)	35	70	140	mVrms
3 dB sensitivity	3dB LS	60 dBμ, 30% mod. output, -3 dB input		13		dBμ
Effective sensitivity	Qs	Input for S/N = 30 dB		15		dBμ
[FM-IF monaural characteristics]: fc = 10.7 MHz, fm = 1 kHz, 100% mod.						
Quiescent current	I_{CCO} (FM)	No input	8	16	23	mA
Demdulator output	V_O	100 dBμ, pin 16 output	120	160	215	mVrms
Signal-to-noise ratio	S/N	100 dBμ, pin 16 output	63	71		dB
Total harmonic distortion (mono)	THD	100 dBμ, pin 16 output		0.5	1.5	%
3 dB sensitivity	3 dB LS	100 dBμ, 100% mod.output, -3 dB input		35	42	dBμ
TU-LED sensitivity	SD-ON	No modulation		45		dBμ
[FM-IF stereo characteristics]: fc = 10.7 MHz, fm = 1 kHz, L+R = 90%, pilot = 10%						
Separation	SEP	100 dBμ, L-mod, pin 16/pin 17 output	25	40		dB
ST-LED sensitivity	ST-ON	100 dBμ, pilot modulation for pin 8 voltage < 0.5V	1.5	3.5	6.3	%
Total harmonic distortion (main)	THD	100 dBμ, main modulation, pin 16 output		0.5	1.5	%
[AM characteristics]: fc = 1000 kHz, fm = 1 kHz, 30% mod.						
Quiescent current	I_{CCO} (AM)	No input	4	7	12	mA
Detector output	V_O1	23 dBμ, pin 16 output	12	25	40	mVrms
	V_O2	80 dBμ, pin 16 output	52	78	117	mVrms
Signal-to-noise ratio	S/N1	23 dBμ, pin 16 output	15	20		dB
	S/N2	80 dBμ, pin 16 output	47	53		dB
Total harmonic distortion	THD	80 dBμ, pin 16 output		0.5	1.5	%
TU-LED sensitivity	SD-ON	No modulation		30		dBμ

Pin Description and Quiescent Voltage at Vcc = 3.0V

Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
1	AM RF input	1.2	1.2	 A10836	AM antenna coil connected between pins 1 and 2 (reg)
2	Reg	1.2	1.2	 A10837	

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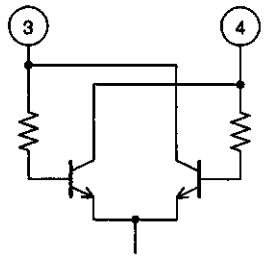
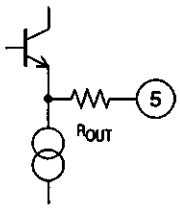
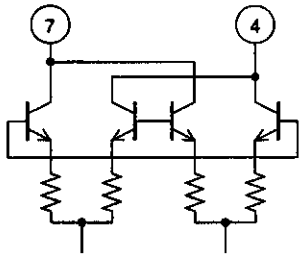
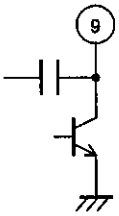
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
3	AM-OSC	3.0	3.0	 A10838	Oscillator coil connected between pins 3 and 4 ($V_{CC}1$)
4	$V_{CC}1$	3.0	3.0		AM/FM-IN/MPX block V_{CC}
5	FM mixer output	1.4	1.2	 A10839	R_{OUT} = 270Ω
6	GND1	0	0		AM/FM-IN/MPX section ground
7	AM mixer output	3.0	3.0	 A10840	Mixer coil connected between pins 7 and 4 ($V_{CC}1$)
8	Tu-LED output	3.0	3.0	A10841	Active low Open-collector output can directly drive LED (I_C max = 20 mA)
9	ST-LED output and AM-IF output	3.0	3.0	 A10842	Active low Open-collector output can directly drive LED (I_C max = 20 mA) In AM operation, AM-IF signal (450 kHz) is output here.

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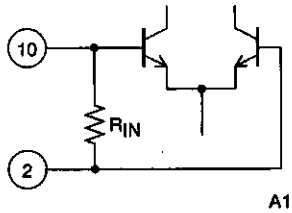
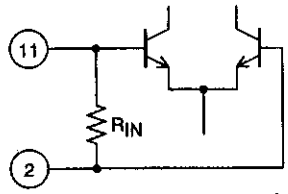
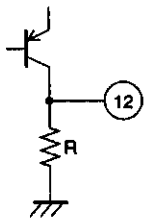
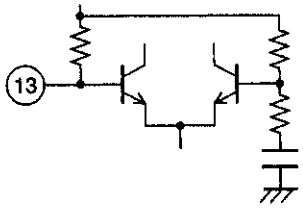
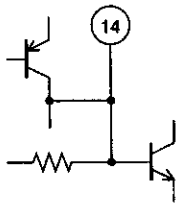
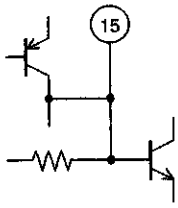
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
10	FM-IF input	1.2	1.2	 A10843	R_{IN} = 330 Ω
11	AM-IF input	1.2	1.2	 A10844	R_{IN} = 2 kΩ
12	AM-AGC output and FM signal meter output	0.5	0.1	 A10845	Internal load resistance R = 16.6 kΩ
13	FM detector	2.4	2.2	 A10846	Reccomended ceramic discriminator CDF107F-AE-019 (Toko) CDA10.7MG83 (Murata)
14	Pilot tone detector filter and forced mono switching	1.7	2.3	 A10847	Mono mode is forced on by connecting pin 14 to ground.
15	Phase comparator filter and AM/FM switching	0	2.3	 A10848	FM reception mode is enabled when pin 15 is open. AM reception mode is enabled when pin 15 is connected to ground.

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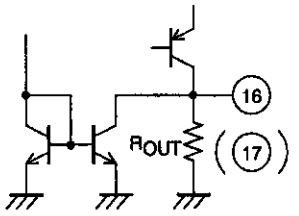
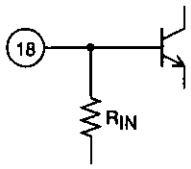
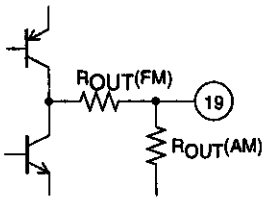
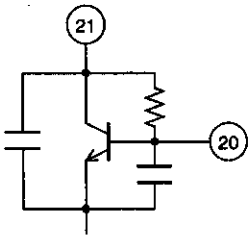
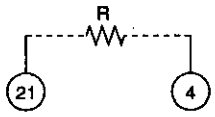
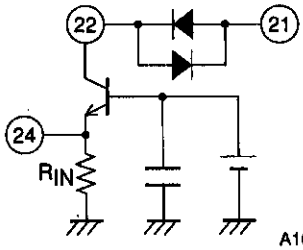
Pin number	Function	Quiescent voltage (V) AM	Quiescent voltage (V) FM	Equivalent circuit	Remarks
16 17	L output R output	1.2	1.2	 A10849	R_{OUT} = 7.5 kΩ
18	MPX input	1.2	1.2	 A10850	R_{IN} = 50 kΩ
19	FM detector output and AM detector output	0.4	1.2	 A10851	Output impedance AM: R_{OUT} = 50 kΩ FM: R_{OUT} = 500 Ω Capacitance between pin 19 and ground should be optimzed for the best separation characteristics.
20	FM-OSC	3.0	2.9	 A10852	Colpitts oscillator circuit FM oscillator coil is connected to pin 20.
21	$V_{CC}2$	3.0	2.9	 A10853	FM-FE block V_{CC} Power is supplied from pin 4 ($V_{CC}1$) via external resistor (10 Ω).
22 24	FM-RF output FM-RF input	3.0 0	2.9 0.8	 A10854	FM RF coil is connected between pins 22 and 21 ($V_{CC}2$). R_{IN} = 1.8 kΩ
23	GND2	0	0		FM-FE brock ground

Coil specifications (bottom view)

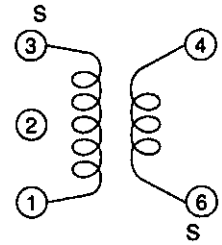
• FM-BPF: SA-309 (Sumida) 88 to 108 MHz

• FM-RF: SA-149 (Sumida) 3.6 mm dia., air core, 0.6 mm wire, 4 1/2 T

• FM-OSC: SA-151 (Sumida) 3.6 mm dia., air core, 0.6 mm wire, 3 1/2 T

• FM-IF filter, discriminator:
SK107M1-AE-10, CDF107F-AE-019, Rs=510Ω (Toko)
SEF10, 7MA5, CDA10.7MG83, Rs=470Ω (Murata)

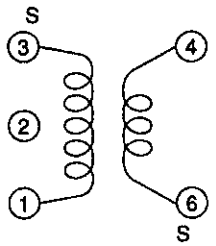
• AM-OSC: SA-181 (Sumida)



A10830

⑥ - ④ 37T
③ - ① 74T
0.06 UEW
f_0 = 796 kHz
$Q_0 \geq 80$
L = 140μH

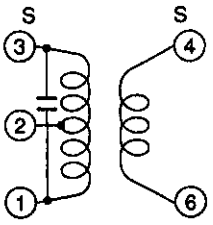
• L7BRS-3132AQ (Toko)



A10831

③ - ① 64T
⑥ - ④ 32T
0.06 2UEW
f_0 = 796 kHz
$Q_0 \geq 65$
L = 140 μH

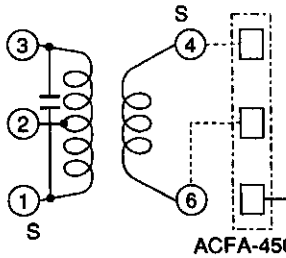
• AM-IFT: SA-1136 (Sumida)



A10832

③ - ② 122T
④ - ⑥ 9T
② - ① 62T
0.06UEW
f_0 =450 kHz
$Q_0 \geq 65$
With 180 pF
internal capacitor

• PCFAZ-082 (Toko)



ACFA-450L08

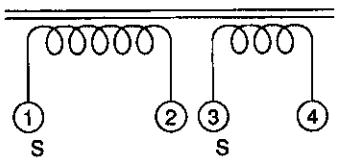
A10833

① - ② 47T
② - ③ 100T
④ - ⑥ 12T
f_0 = 450 kHz
With 180 pF
internal capacitor
With AM-IF filter

• AM-IF filter: SFU450B (Murata)

• Poly-varicon:
FT-2217 (Toko)
PVC-22KTL (Mitsumi)

• MW Bar- antenna: TYA-1005 (Mitsumi)



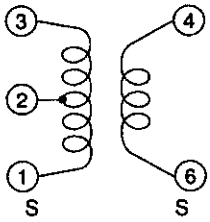
A10834

① - ② 68T
③ - ④ 9T
f_0 = 796 kHz
$Q_0 \geq 230$
L = 260 μH

For DUT PCB

• FM-Discriminator: CDA10.7 MG1-B (Murata)

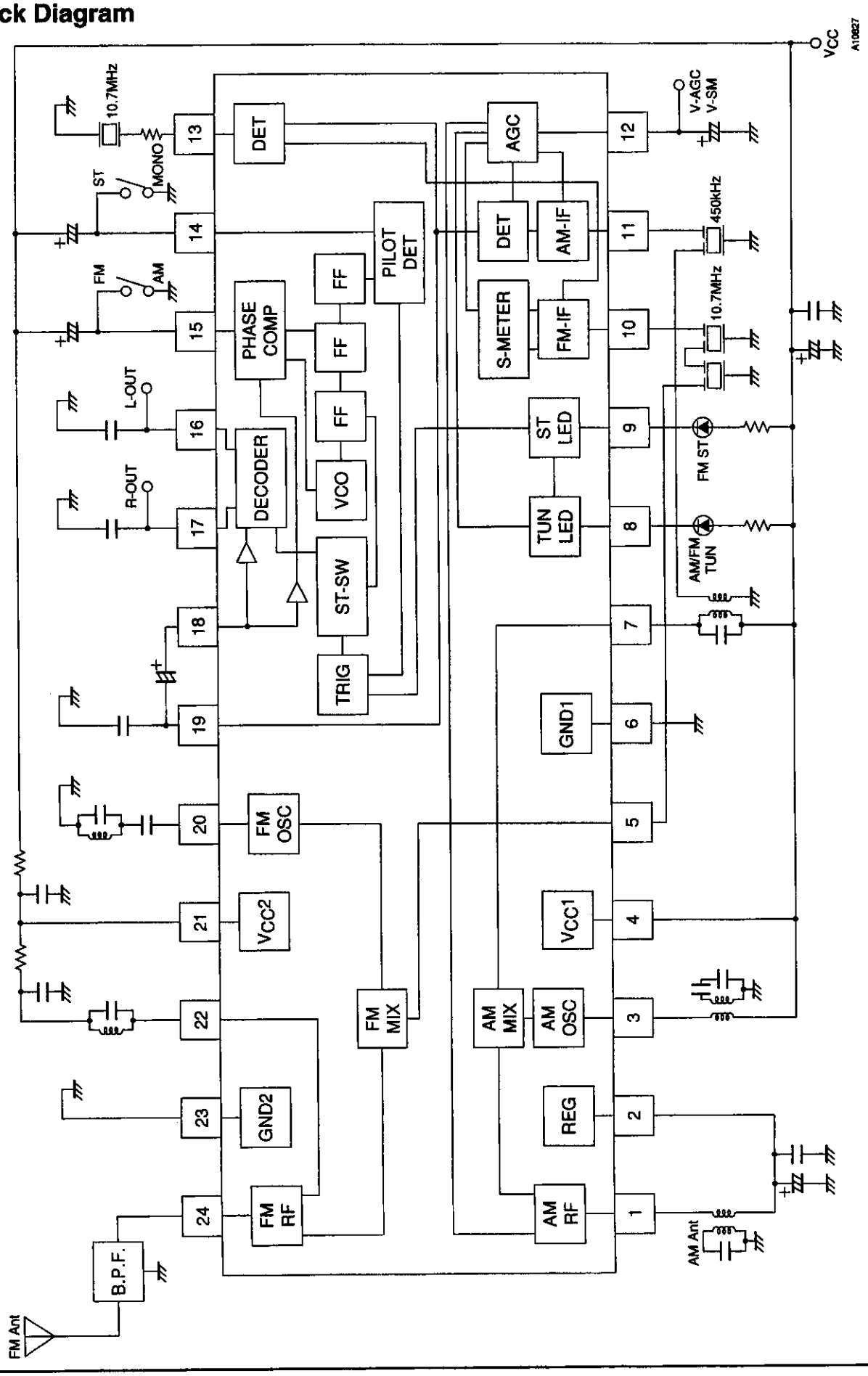
• AM-OSC: SA-1135 (Sumida)



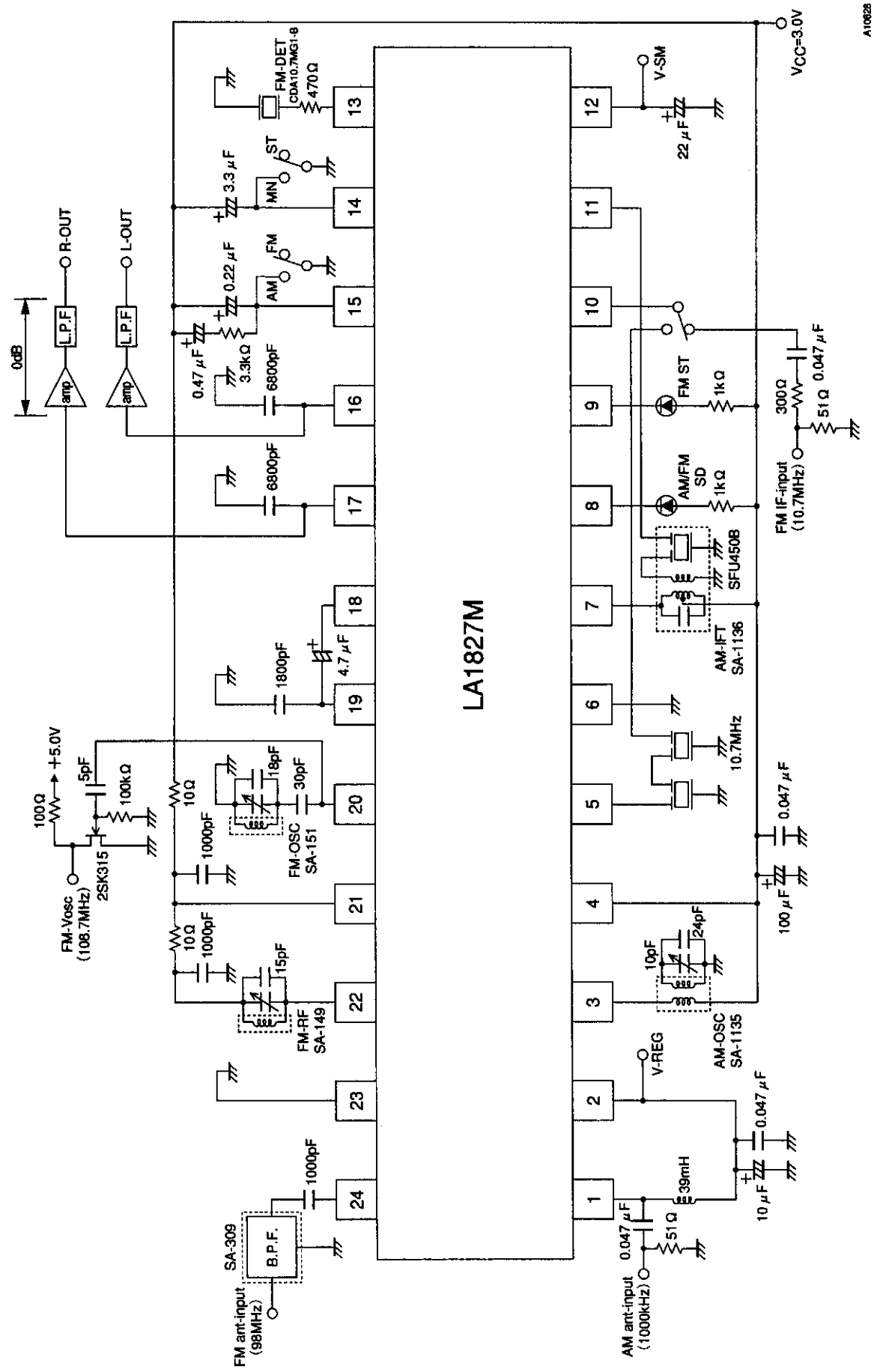
A10835

⑥ - ④ 11T
① - ② 99T
② - ③ 3T
0.06UEW
f_0 = 796 kHz
$Q_0 \geq 80$
L = 270 μH

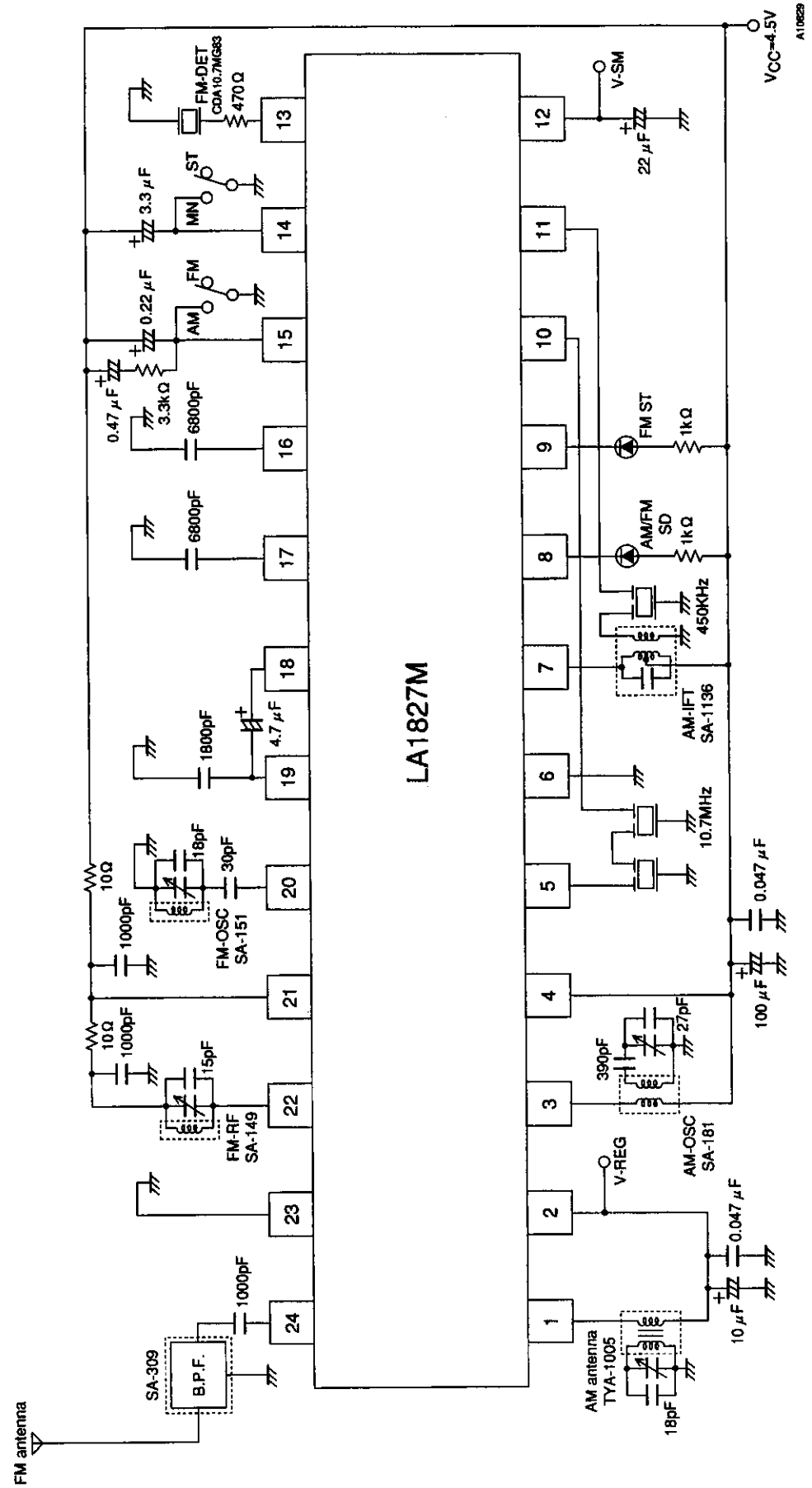
Block Diagram



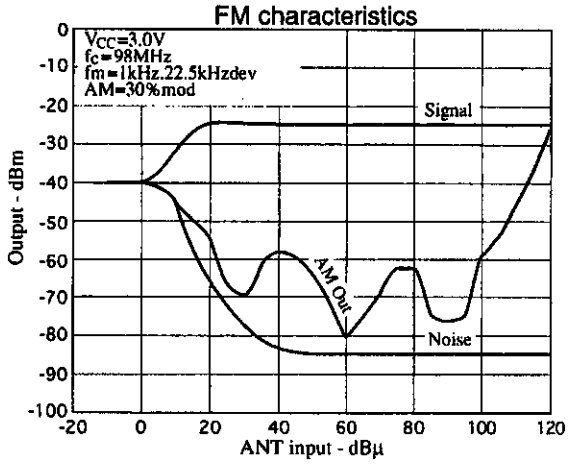
Test Circuit



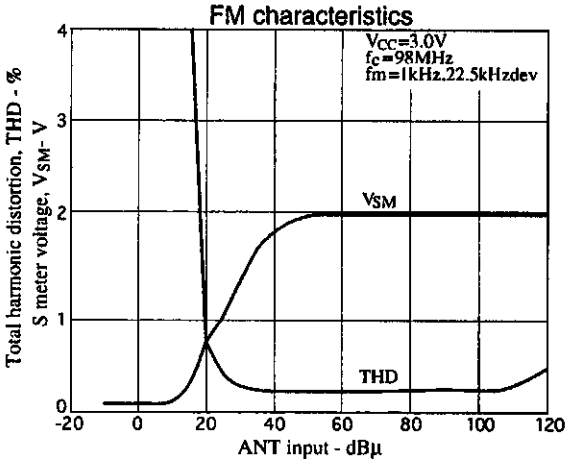
Sample Application Circuit



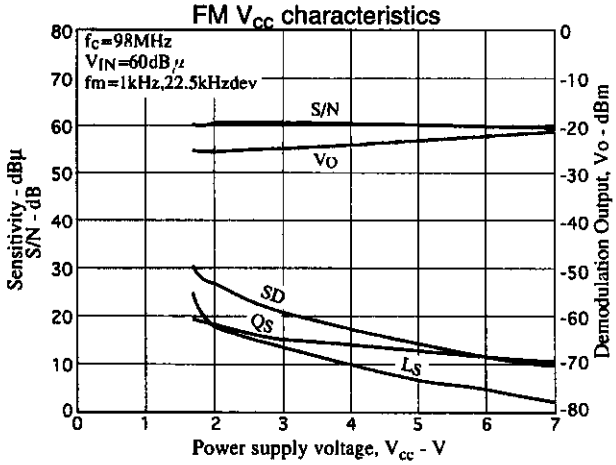
FM characteristics



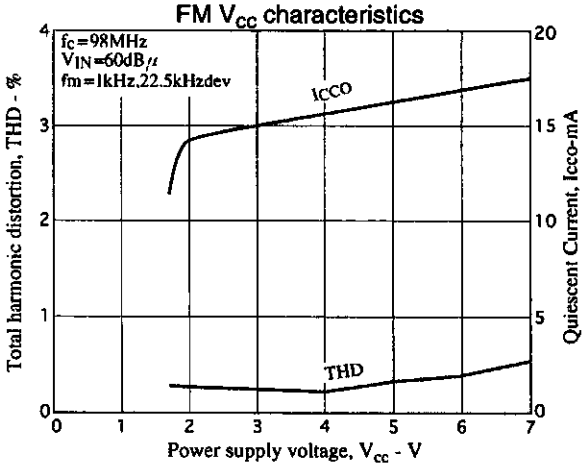
FM characteristics



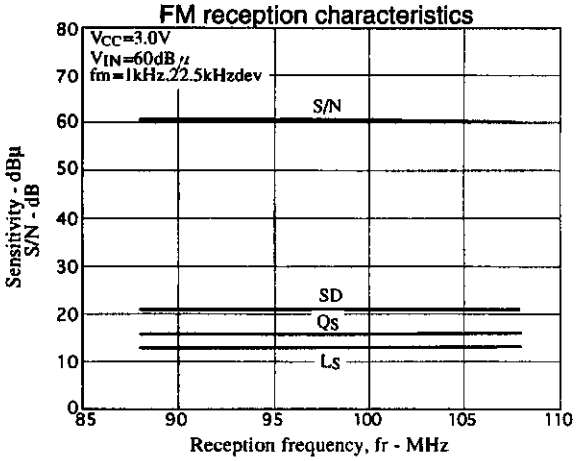
FM V_{CC} characteristics



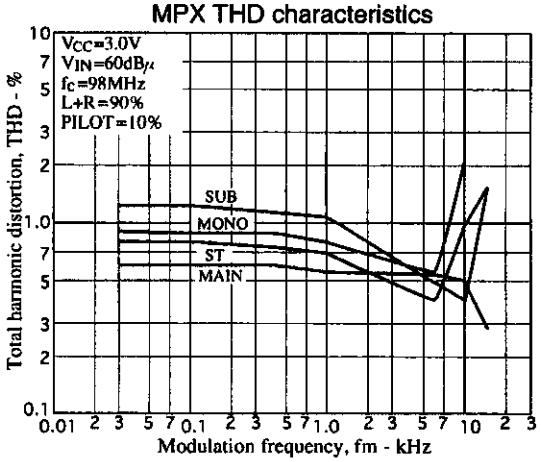
FM V_{CC} characteristics



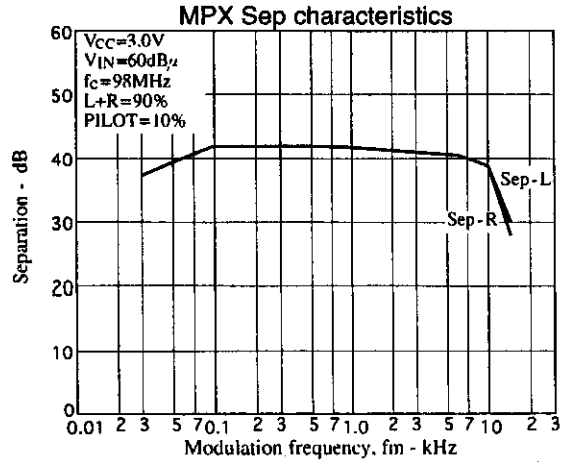
FM reception characteristics



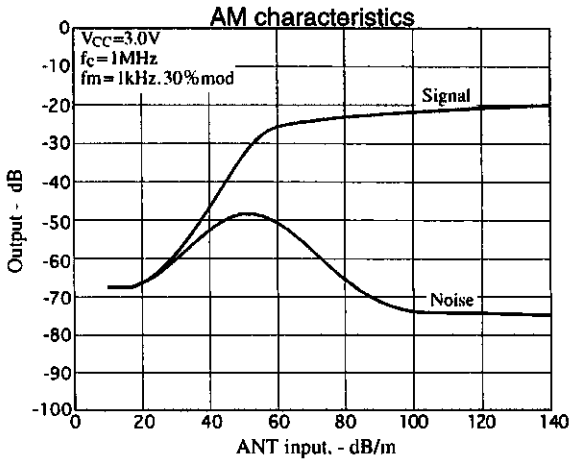
MPX THD characteristics



MPX Sep characteristics



AM characteristics



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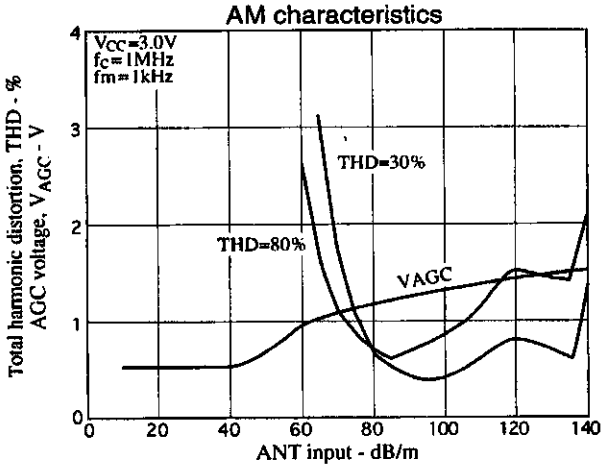
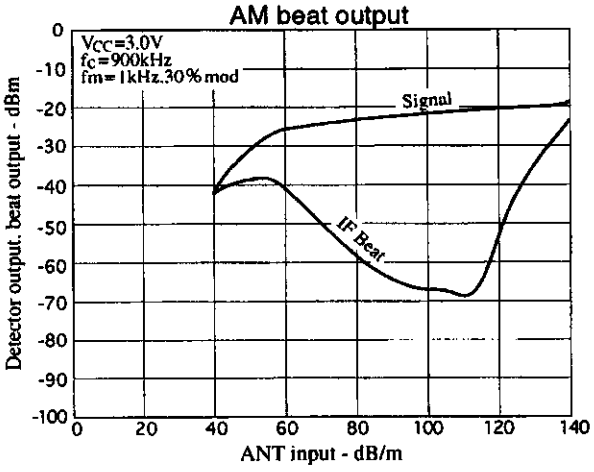
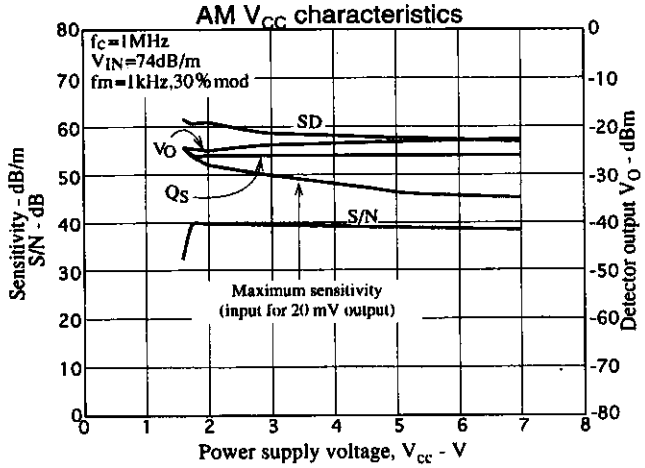


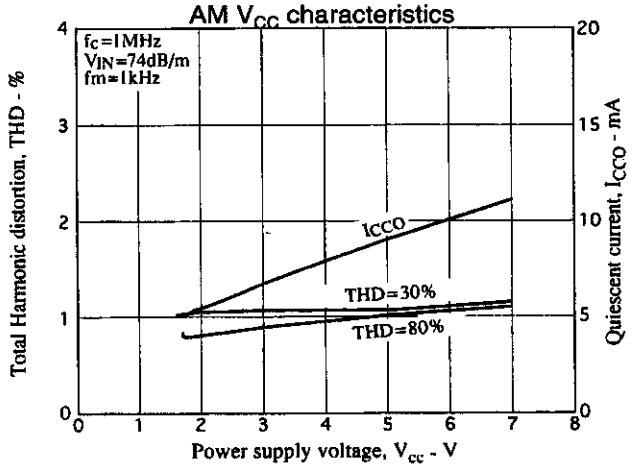
AM beat output



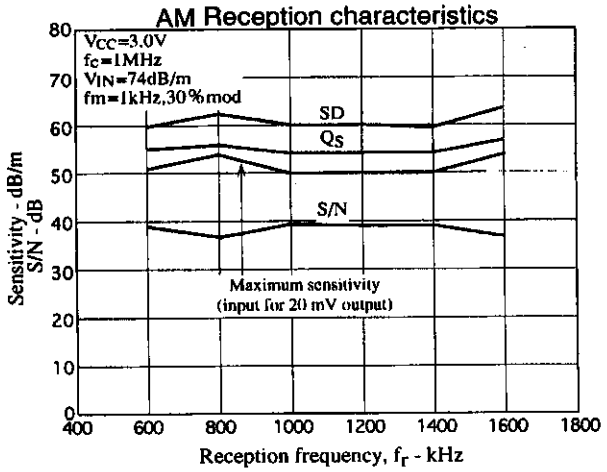
AM V_{CC} characteristics



AM V_{CC} characteristics



AM Reception characteristics



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